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NOTES ON SWORDFISH AT CAPE BRETON, NOVA SCOTIA

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INTRODUCTION

Louisburg, Cape Breton Island, is the seat of an important swordfish fishery. Swordfish (*Xiphias gladius*) were abundant off this port when we visited it from July 28 to August 25, 1936, with the Michael Lerner–Cape Breton Expedition, on a good day over 300 fish being landed there. They were taken from some twenty to thirty miles offshore to close inshore, not more than a mile or two from the coast line.

In addition to exhibition material desired by The American Museum of Natural History, we obtained considerable data on swordfish and familiarized ourselves with certain problems concerning the habits of the species, here discussed.

FEEDING HABITS

The swordfishing season at Louisburg is between the latter part of July and early October. Although fish weighing as little as 60 lbs. dressed are said to have been brought in, the average weight is around 265 lbs. dressed.

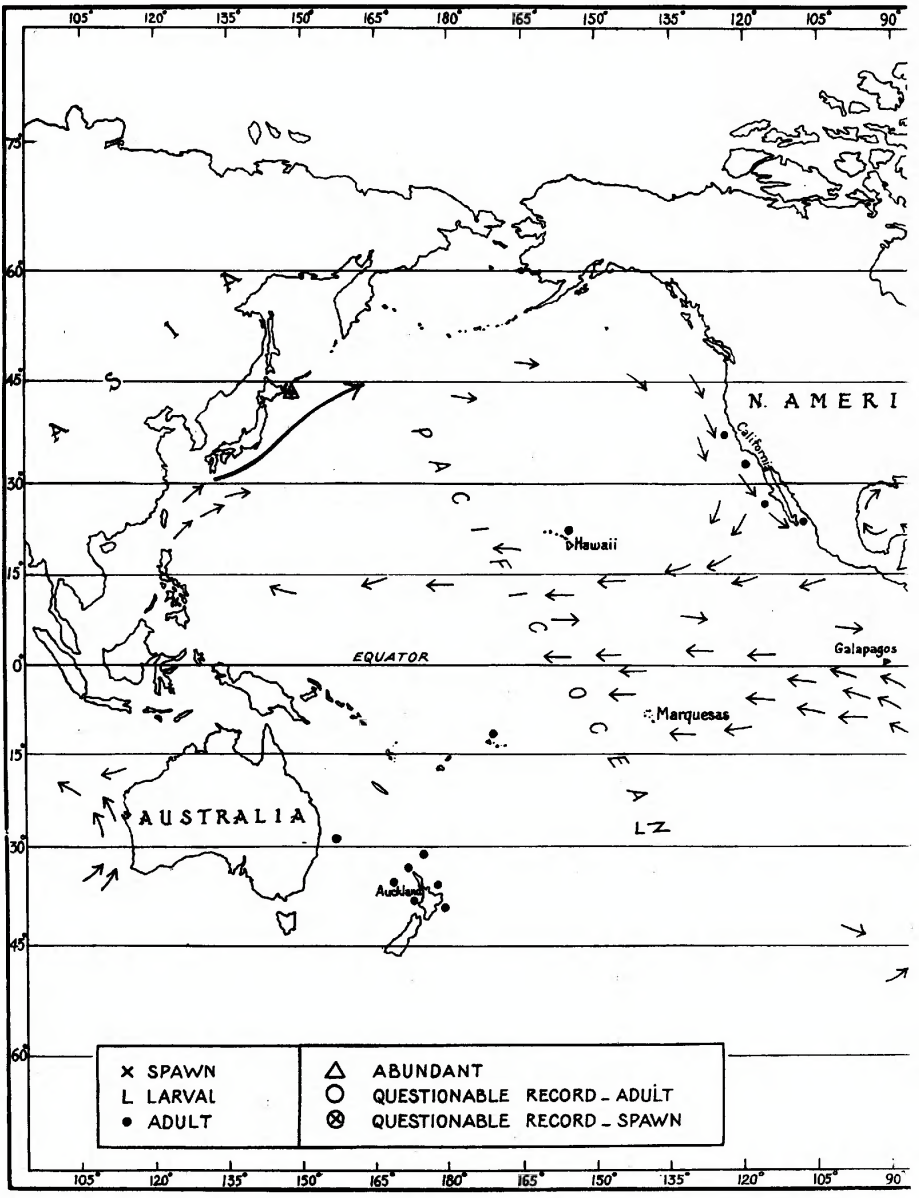
The fish are taken with the harpoon while swimming lazily, resting at the surface, commonly with the dorsal fin and the upper lobe of the caudal projecting above the water. They are usually met with thus on sunny days with little wind, and it is on such days that the big takes are made. In overcast, windy weather few are seen or captured.

These habits of the swordfish are well known, and will be found in almost any discussion of the species.[1] Their significance, however, seems to have been quite generally overlooked. We examined stomachs of numerous swordfishes landed at Louisburg, and found all of them from half full to jammed with food. Presumably the fish loafs at the surface when it has fed, idleness and relative warmth aiding digestion. When located, such fish may be tempted to strike at a bait, but they are not actively feeding.[2]

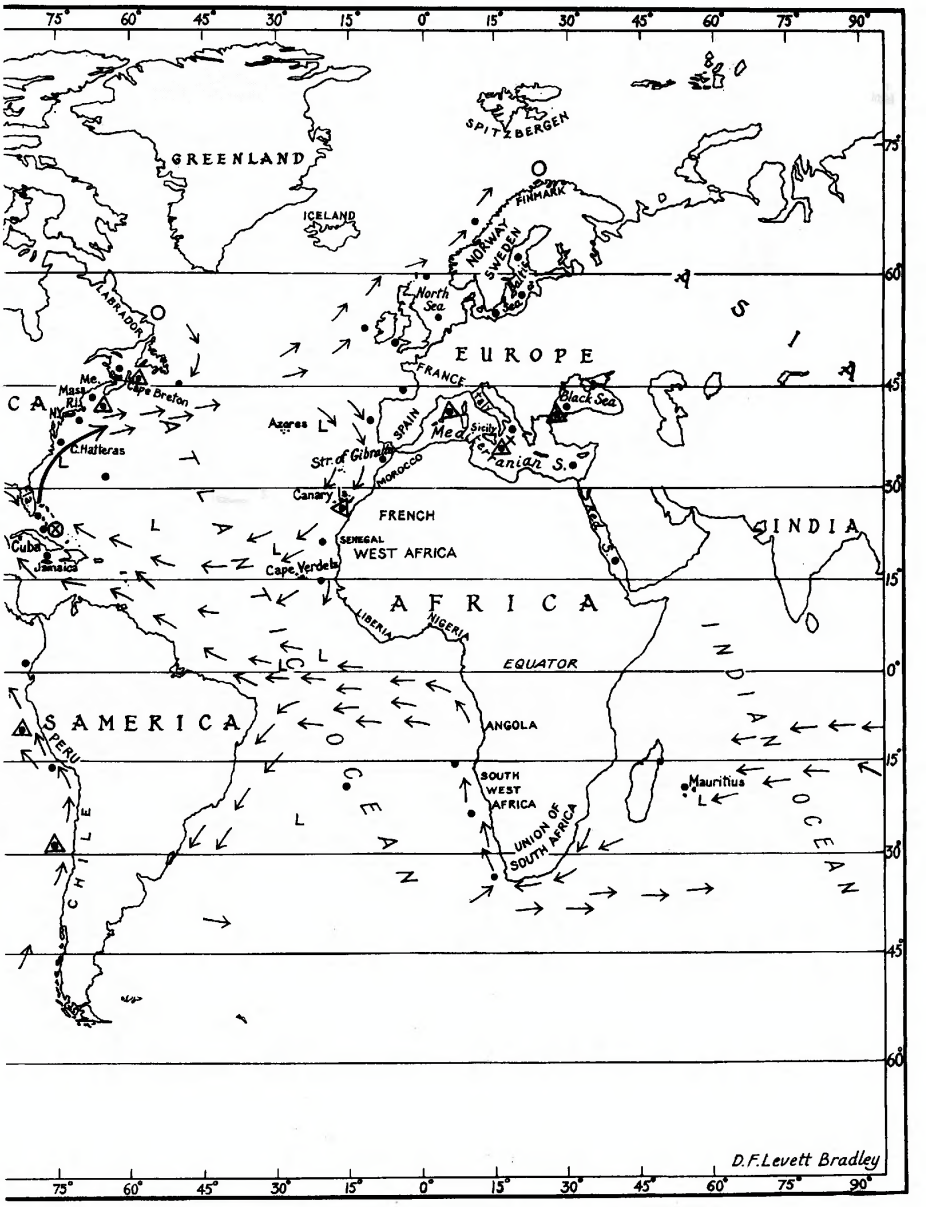
There is no question that the swordfish were off Louisburg to feed on schools of herring. All but a small part of the stomach contents ex-

[1] Bigelow and Welch, 1925, Bull. U. S. Bur. Fish., XL, pt. 1, p. 225. Goode, 1888 'Amer. Fishes, p. 242.

[2] Lehmann, 1935, in 'Amer. Big Game Fishing,' p. 138.



Swordfish distribution and



ocean currents (arrows).

amined consisted of herring so far as determinable; many were large herring with roe. Exceptions are the stomach of one large fish (dressed weight 520 lbs.) which contained about 12 herring and one whole dogfish (*Squalus*), and that of a small one which held three large herring, a whole 12-inch squid and fragments of two or three other squids. This individual was the only swordfish on which really distinct lamprey marks were noticed,[1] and its herring were unusually fresh and little digested, details which may be evidence of its having just come in from other grounds. Single squid were also found among the usual herring in a specimen of 248 lbs. dressed weight, on August 21, and in one of 495 lbs. dressed weight on August 22.

The swordfish belongs to a warm water tribe, and, other things being equal, might be expected to remain in comparatively warm water. It presumably invades the Georges–Nova Scotia area in summer to feed on the northern schooling fish and squid found there. When it has fed, it might reasonably be supposed to seek the warmest water available to digest its meal, and that it does so seems to be the case.

It is the generally accepted belief among fishermen that the normal manner of feeding of the swordfish is to strike into schools of smaller fishes, killing and disabling them with its sword and then picking up the victims.[2] This would not be an easy habit to observe; impossible except where swordfish are feeding at the surface. That it does not always pertain is evidenced by Mr. Lerner's success in getting swordfish, sighted at the surface, to strike at a trolled mackerel bait. That it may well be their general habit is favored by the circumstantial evidence. Their sword supplements a rather inadequate oral equipment for a predaceous fish, and the species commonly found in their stomachs are close-schooling forms.

SPAWNING HYPOTHESIS

The adult swordfish is a temperate zone species, although sufficiently tolerant of temperature variations to occur in small numbers from the tropical waters of Florida to the subarctic waters of Newfoundland or even Labrador.[3] Its pelagic, more or less drifting larval stages, on the other hand are very likely confined to warmer water, as are the swordfish's relatives. One excellent reason why swordfish that abound on the Georges–Nova Scotia banks in summer do not spawn there at the

[1] We found no remoras on swordfish examined, nor external parasites, with the exception of a parasitic copepod, *Pennella filosa* (L.) observed several times.

[2] Bigelow and Welch, *loc. cit.*, p. 225.

[3] A Cape Breton swordfish fisherman reported seeing swordfish off Labrador, and that the Eskimos found them plentiful there—an interesting observation which we believe requires corroboration.

season when Mediterranean individuals are thought to spawn may be that their young would not thence readily reach any suitable ocean basin. Even did they get into the western edge of the Gulf Stream drift, they would be carried northeastward to unsuitable latitudes.

Swordfish on the American coast in summer have inactive gonads. The fish are there because they find it a favorable feeding ground, and as the season advances they become fatter and better nourished. The ensuing fall or winter would be the logical time for them to spawn, and it is presumably the time that they do spawn—but where? On this point there is little evidence, and much of it negative, but such as it is points to the Canaries Current off the west coast of Africa. The scarcity off our coast of small swordfish of only a few pounds weight, such as occur in the Mediterranean, indicates that there is no nursery ground in the western side of the Gulf Stream drift, as there should be if the species spawned in the Western Atlantic. Moreover, a spawning ground off Africa would provide warm temperate water for the parent fish, whence the drift would be toward a suitable tropical basin for the young. Finally, this would place the unknown spawning ground of the American fish adjacent to the known spawning ground of the European, with a spawning season from winter to summer northward, dependent on latitude, such as fishes frequently show on a long stretch of coast.

THE BANKS

Cape Breton seems to be the most northeasterly point on our coast where swordfish are abundant. They are equally, or more abundant on Georges Bank and are found westward to the east end of Long Island in smaller numbers. A few also occur in the Gulf of Maine.

For purposes of discussion, zoögeographers divide the land into faunal areas over which physical conditions and the resulting aspects of life are comparatively uniform. Perhaps it is the sameness of the unfamiliar which has prevented the seas' being classified in like manner or to the same extent. We believe it would be advantageous to consider waters of the continental shelf from Georges Bank to Cape Breton Island a unit faunal area, which might be known as the Georges–Nova Scotia shelf. Ten to twenty miles off Louisburg, the green water with drifting rockweed looks much the same as Georges Bank to man or to swordfish. This area is cold in winter and with relatively warm surface water in summer, warmer than the immediate shore waters of the Gulf of Maine where tides in the Bay of Fundy and prevailingly offshore winds farther south bring the colder, deeper strata to the surface.

At any season, abruptly warmer temperatures in the Gulf Stream drift skirt the outer southeast edge of the Georges–Nova Scotia shelf, but, due to oceanographic barriers, these warmer waters invade it little. The principal outside influences are in intermittent currents which circle the Gulf of Maine from the east or northeast. These are warm in summer and fall, and as they reach the northeast end of the area most directly they tend to compensate for latitude and make it a unit physically separable from Newfoundland banks by relatively warmer summer surface temperatures. They are, however, cold in winter and spring, wiping out any such considerable temperature break with the subarctic.[1]

As regards the relation of Louisburg to this faunal area, we were there at a date when impingement of warmer, offshore surface water on the coast could be observed. From July 29 to August 1, there was a band of surface water of some 55° F. along the coastline, extending at least five miles offshore on the former date. Harbor temperatures, presumably from local warming were around 60°, and temperatures ten to twenty miles offshore also around 60°. Strong westerly currents along the shore reported for two or three days after a full moon on August 2 seem to have been correlated with obliteration of this belt of cold water. On August 4, the temperature just outside Louisburg was 60°; close to Scatari Island, 63°; on August 6, it was 65° just outside and 66° some five miles offshore; still 60° well inside the harbor. Between August 8 and August 25, inshore temperatures varied from 59° to 68°; on August 13 and 14, those fifteen to forty miles offshore were 68° to 69°.

The strictly shore fauna was very limited. Cunners (*Tautogolabrus adspersus*) were plentiful about the weed-grown piles of the docks, and a few eels and sticklebacks were present, but surprisingly few species were noticed and the large amount of swordfish waste going overboard each day was not being utilized. Very likely, summer temperatures are too high for cold-water fishes, and the long stretch of cold shore of the Gulf of Maine a barrier to those for which these temperatures would be appropriate, although we know that numerous southern species straggle across the banks to Nova Scotia.[2] One may say that the Georges–Nova Scotia bank faunal area comes quite up to the shore here, as it does not farther south. Among summer surface species characteristic of it, we observed, other than the swordfish, the blue shark (*Prionace glauca*), which seemed to be common, and the black rudder fish (*Palinurichthys perciformis*). Of offshore birds there were a few red phalaropes

[1] Bigelow and Welch, 1928, Bull. U. S. Bur. Fish., XL, pt. 2.
[2] Vladykov and McKenzie, 1935, 'Marine Fishes of Nova Scotia,' Proc. Nov. Scot. Inst. Sci., XIX, pt. 1.

in gray plumage, and a few procellariiformes, greater and sooty shearwaters and the Wilson's petrel, but not the Leach's petrel. A school of blackfish and a little piked whale were seen; two porpoises, a *Phocaena* and *Lagenorhynchus acutus* were brought in. *Phocaena* is probably less numerous than in colder waters; the whale and the other porpoise are very likely characteristic of this area.

The rockweed along the shore was not particularly luxuriant, and only a little was cast up along the beaches. This was evidently of local origin as was also a little drifting along the coast line. In such drifting weed a small amphipod, *Calliopius laeviusculus* (Kröyer), abounded, and nothing else was found. The same amphipod was abundant in weed growing in shallow water. Ten or twenty miles offshore, drifting rockweed became much more plentiful, and it would be interesting to know its place of origin. The luxuriant growth of this weed on the tide-swept shores of the Gulf of Maine presumably accounts for its abundance on Georges Bank.